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CH_4 and CO_2thermodynamic and kinetic sorption/desorption behaviour of Chinese coals

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China is the world's largest coal producer and the most important emitter of coal mine methane (CMM). By combining CMM utilization and CO_2 storage in coal seams with enhanced coal-bed methane (CBM) recovery (CO_2-ECBM), China could benefit of a win-win effect and meet the needs of the present without compromising the ability of future sustainable development.

An improved understanding of the interaction of methane and CO_2 with coals is a prerequisite for the design and application of these new technologies. For the current study, 13 coal samples from different Chinese coal basins were obtained. Three of these samples with different maturity levels (anthracite, bituminous coal, lignite) were selected for high pressure CH_4 and CO_2 adsorption/desorption experiments at temperatures between 35 and 60˚C and pressures up to 20 MPa.

The study aims at a detailed investigation of the influence of temperature, pressure, water content, particle size and coal properties on the sorption/desorption behaviour under both, thermodynamic and kinetic aspects.

The experimental data will be analysed and interpreted using various thermodynamic sorption/desorption models in order to arrive at an optimum representation of the diversity of the sample set. A bi-disperse model is used to describe the sorption/desorption kinetics. The main points of research in this study are as follows:

1. Assessment of CH_4 and CO_2 sorption capacities (thermodynamics);
2. Sorption/desorption kinetics of different grain size fractions;
3. Determination of heat of adsorption;
4. Development of numerical models describing the thermodynamic and kinetic sorption behaviour of Chinese coals;
5. Design of tools for implementation into CO_2-ECBM reservoir simulation software.